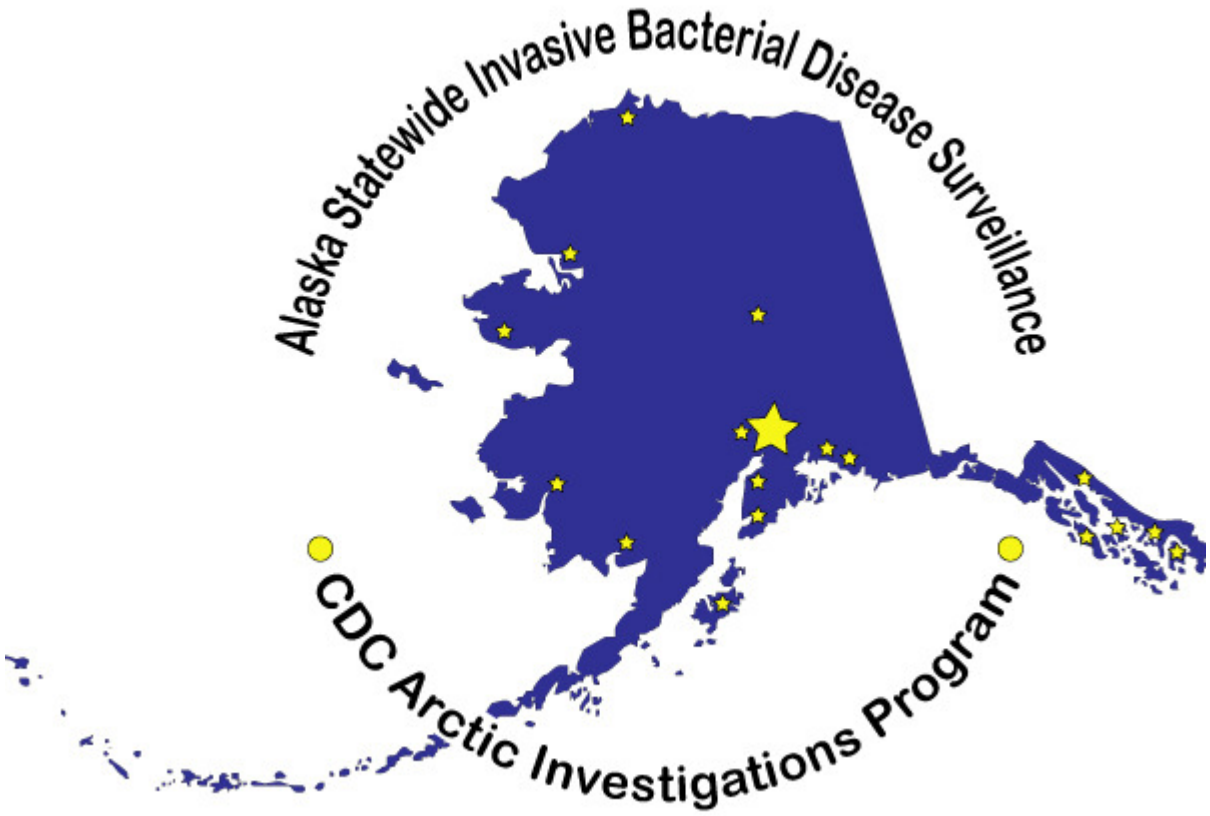

Surveillance of Invasive Bacterial Disease in Alaska, 2008

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Alaska Statewide Invasive Bacterial Disease

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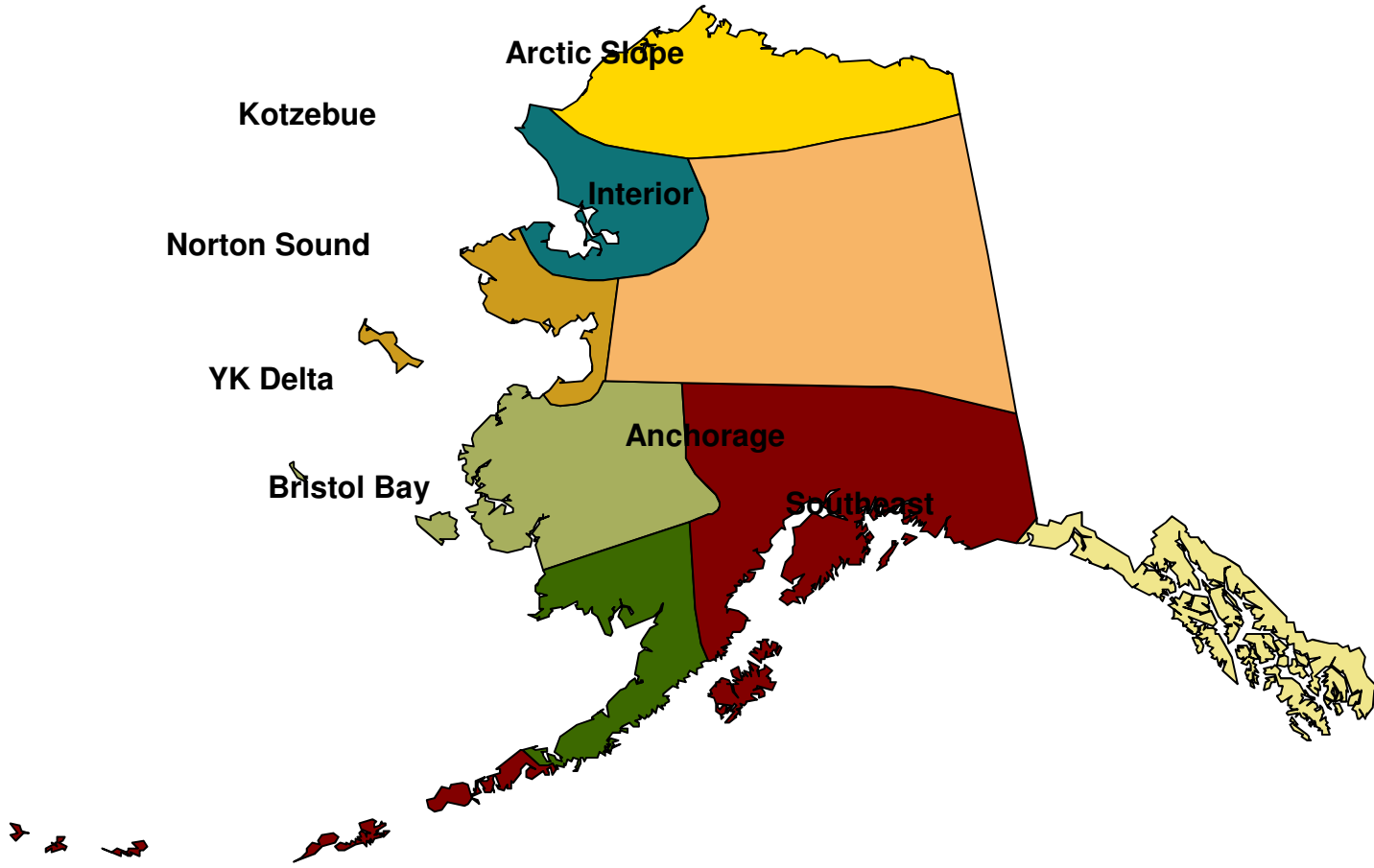
Summary

The Centers for Disease Control and Prevention's Arctic Investigations Program (AIP) in Anchorage, Alaska, maintains a statewide surveillance system for invasive diseases caused by *Streptococcus pneumoniae*, *Haemophilus influenzae, Neisseria meningitidis,* and groups A and B streptococci. Laboratories throughout the state are requested to send to AIP any isolates of these organisms recovered from a blood culture, CSF, or other normally sterile site in an Alaska resident. Isolate identification is confirmed and, when appropriate, serotyped and tested for antimicrobial susceptibility. The objectives of this system are to provide information on disease rates within the state, monitor the emergence of antimicrobial resistance, and to monitor the effectiveness of implemented vaccine programs, such as the 23-valent pneumococcal polysaccharide vaccine, the pneumococcal conjugate vaccine and *Haemophilus influenzae* type b vaccines.

Figure 1: Invasive Bacterial Disease Surveillance Regions – Alaska, 2008



In 2008, the total numbers of cases of invasive disease caused by these organisms reported to AIP were 148 *S. pneumoniae*, 21 *H. influenzae*, 5 *N. meningitidis*, 38 group A *Streptococci* (GAS) and 28 group B *Streptococci* (GBS). Alaska Native people had higher rates of disease than non-Native people for all

surveillance organisms except *Neisseria meningitidis*. Rates of invasive pneumococcal disease were highest in the YK Delta. Rates for each organism by region are presented in the following table.

Table 1: Surveillance Organisms Reported by Region – Alaska, 2008

Region	*S. pneumoniae* n (rate*)	*H. influenzae* n (rate*)	*N. meningitidis* n (rate*)	GAS n (rate*)	GBS n (rate*)
Anchorage	74 (16.4)	9 (2)	4 (0.9)	25 (5.5)	20 (4.4)
Arctic Slope	3 (52.3)	1 (17.4)	0 (0)	0 (0)	0 (0)
Bristol Bay	2 (28.6)	0 (0)	0 (0)	0 (0)	0 (0)
Interior	23 (22.2)	3 (2.9)	1 (1)	1 (1)	4 (3.9)
Kotzebue	3 (37.1)	0 (0)	0 (0)	3 (37.1)	0 (0)
Norton Sound	3 (31.6)	1 (10.5)	0 (0)	0 (0)	0 (0)
Southeast	16 (23.1)	2 (2.9)	0 (0)	3 (4.3)	3 (4.3)
YK Delta	24 (96.4)	5 (20.1)	0 (0)	6 (24.1)	1 (4)
Total	148 (21.8)	21 (3.1)	5 (0.7)	38 (5.6)	28 (4.1)

*Cases per 100,000 population

Introduction

AIP conducts statewide surveillance of invasive *Streptococcus pneumoniae*, *Haemophilus influenzae*, *Neisseria meningitidis*, and groups A and B *Streptococcus*. This program is part of a passive, laboratory-based surveillance system in which laboratories from all hospitals throughout the state are encouraged to participate. The population included in the AIP surveillance is the State of Alaska, which totaled 679,720 persons in 2008 [1]. Case detection occurs year-round as participating laboratories send isolates recovered from sterile sites to the AIP laboratory in Anchorage, accompanied by basic demographic and clinical information on the cases. Materials and forms for isolate shipment and data collection are provided to each laboratory by AIP. At year-end, AIP asks that each laboratory review their records and provide information on any cases that may have been overlooked. In 2008, 23 laboratories in Alaska participated in the invasive disease surveillance system, either by sending isolates to the AIP laboratory throughout the year, conducting year-end record reviews, or both. Beginning in January, 2007, invasive *S. pneumoniae*, GAS and GBS became reportable conditions to the State of Alaska Division of Public Health (DPH). Reports of cases of disease caused by these organisms, along with cases of invasive *H. influenzae* and *N. meningitidis* which were previously reportable, are shared between AIP and DPH.

AIP defines a case of invasive *S. pneumoniae, H. influenzae*, *N. meningitidis*, GAS or GBS as an isolate of the bacteria from a normally sterile site, including blood, cerebrospinal fluid, pleural fluid, peritoneal fluid or joint fluid that has been taken from a resident of Alaska. In addition, for GAS, isolates are requested from deep tissue infections such as might be collected from surgical debridement of cases of necrotizing fasciitis.

Invasive Pneumococcal Disease

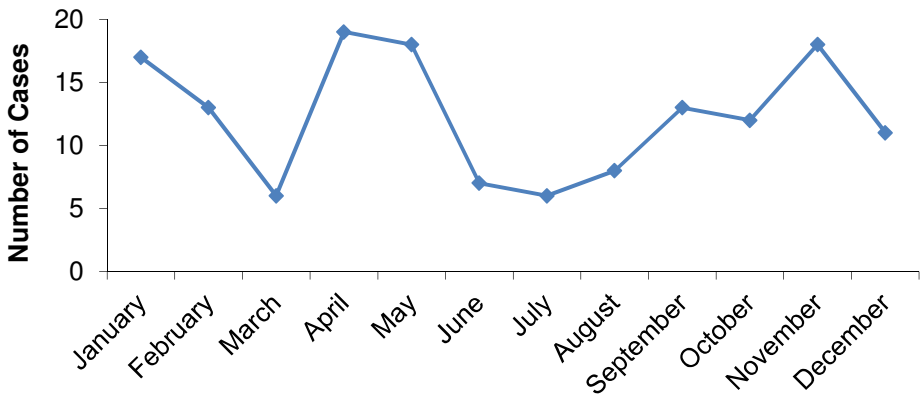
Overall Incidence

A total of 138 pneumococcal isolates were received at AIP in 2008. An additional 3 cases were detected through year-end follow up with participating laboratories, 6 cases through shared surveillance with the State DPH and one case through on-site personnel review of medical records for a total of 148 cases of invasive pneumococcal disease. The overall rate for invasive pneumococcal disease in 2008 was 21.8 cases per 100,000 persons per year. Alaska rates for 2008 were higher than the Active Bacterial Core Surveillance (ABCs) 2008 national projected rate of 14.5/100,000 [2]. ABCs is a surveillance system operated in 10 states which covers a population of over 39 million persons.

Seasonality

Invasive *Streptococcus pneumoniae* cases were identified in each month of 2008. The largest number of cases was reported in April.

Figure 2: Invasive Pneumococcal Disease, by Month of Culture - Alaska, 2008



Race

In 2008, the state population was comprised of 19.8% Alaska Native people *(Alaska Natives 134,633, non-Natives 545,087)* [1]. Of all reported *S. pneumoniae* cases in 2008, 51% occurred among Alaska Native people for a total of 76 cases; the age-adjusted rate was 54.4/100,000 persons per year. Seventy-two cases occurred among the non-Native population with an age-adjusted rate of 11.8/100,000 persons per year. The rate ratio of age-adjusted rates of *S. pneumoniae* disease for the Alaska Native population compared with the non-Native population in 2008 was 4.6.

Table 2: Invasive *Streptococcus pneumoniae* Cases by Race – Alaska, 2008

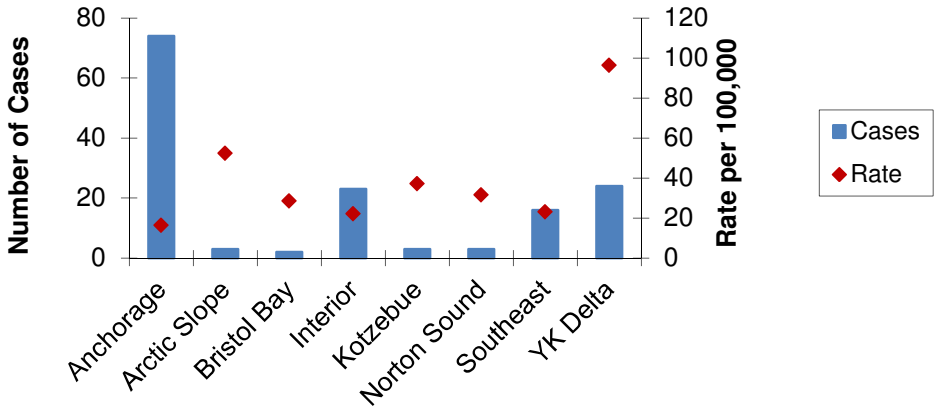
Race	Cases n (%)	Age Adjusted Rate*	% Male	Deaths n (%)
Alaska Native	76 (51)	54.4	46	7 (9.2)
Non-Native	72 (49)	11.8	54	6 (8.3)
Total	148		50	13 (8.8)

*Cases per 100,000 per percent distribution of Alaska 2000 population

Region

The highest percentage (50%) of invasive pneumococcal disease cases occurred in the Anchorage area in 2008. Rates of disease, however, were highest in the YK Delta (96.4/100,000 persons per year).

Figure 3: Invasive Pneumococcal Disease, Cases & Rates by Region - Alaska, 2008

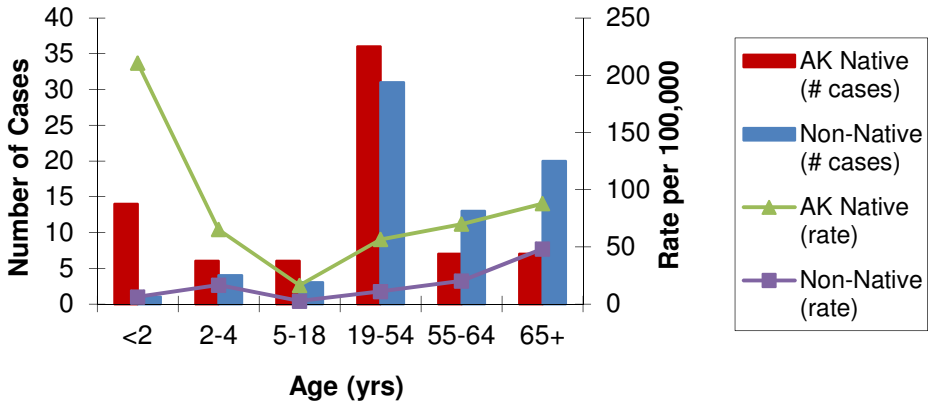


Age

Cases occurred in all age groups in 2008 ranging from 4 months to 101 years with a median age of 46 years. Overall, the highest rates of disease occurred in children less than 2 years old.

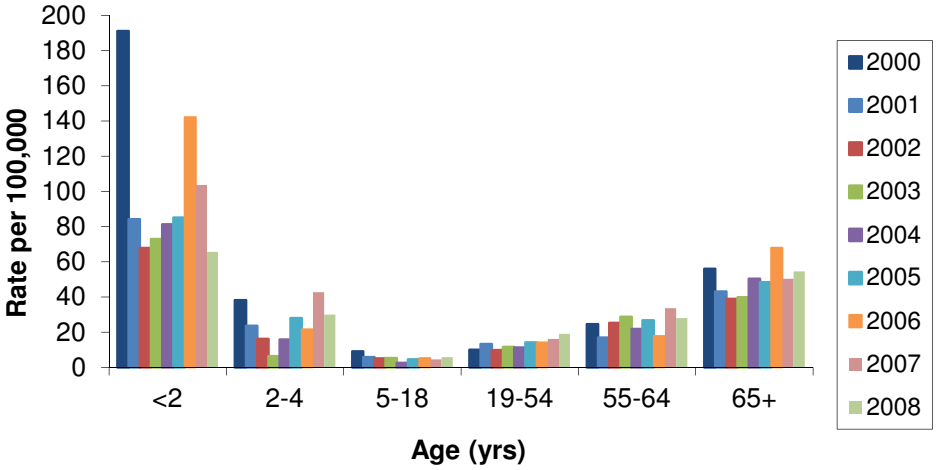
When stratified by age and race, the highest rates of disease in 2008 occurred in Alaska Native children less than 2 years old (210.7/100,000 persons per year).

Figure 4: Invasive Pneumococcal Disease, Cases & Rates by Age Group & Race - Alaska, 2008



Since the initiation of a pneumococcal conjugate vaccine program in 2001, overall rates of invasive disease have declined dramatically in children less than 2 years of age [3]. In 2000, overall yearly rates of pneumococcal disease in children less than 2 years were 191.2/100,000, dropping to a low of 67.9/100,000 in 2002 and then increasing to 142.2/100,000 in 2006. In 2008, the rate of invasive pneumococcal disease in children less than 2 years declined to 65.6/100,000 which is the lowest rate observed in this age group since vaccine introduction.

Figure 5: Invasive Pneumococcal Disease by Age Group - Alaska, 2000-2008



Although pneumococcal disease rates dropped initially in AK Native and non-Native children less than 2 years of age after 2000, the rates of disease in AK Native children less than 2 years trended upward from a low of 93.6/100,000 in 2001 to 335.9/100,000 in 2006. This increase in rates is due primarily to disease caused by serotypes not contained in the pneumococcal conjugate vaccine [4,5]. Although the rate of invasive pneumococcal disease in AK Native children less than 2 years in 2008 was 210.7/100,000, this is 34 times the rate of disease seen in non-Native children. Rates of invasive disease in non-Native children less than 2 years declined during the same time period reaching 26.8/100,000 in 2005, increasing to 64.4/100,000 in 2007 and declining in 2008 to 6.2/100,000.

Figure 6: Invasive Pneumococcal Disease in Alaska Natives, by Age Group - Alaska, 2000-2008

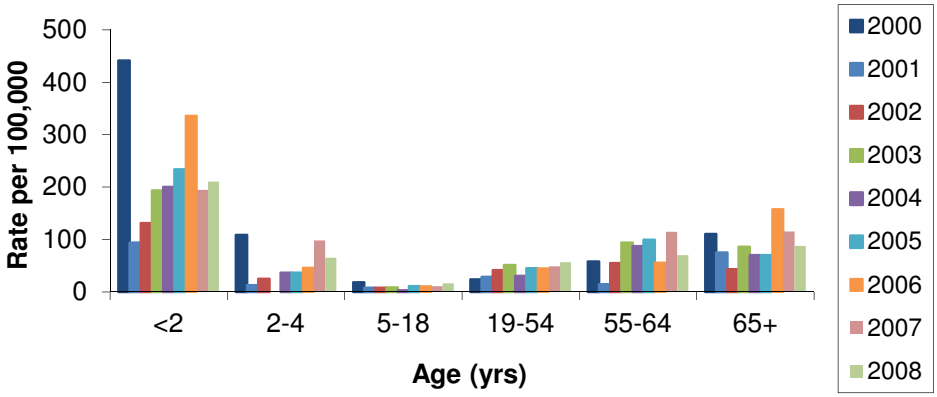
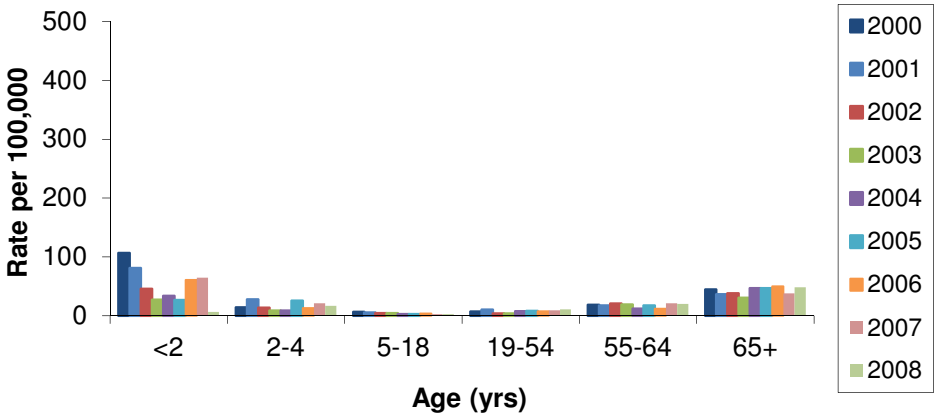


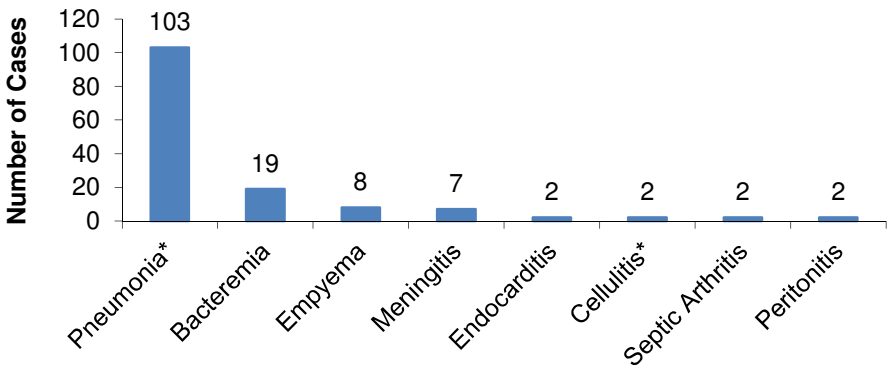
Figure 7: Invasive Pneumococcal Disease in Non-Natives, by Age Group - Alaska, 2000-2008



Clinical Presentation

The primary clinical presentation was determined by a review of the discharge diagnoses in each patient's individual medical record associated with the invasive bacterial illness. In cases with multiple discharge diagnoses, the most serious diagnosis related to the pneumococcal infection was recorded as the primary clinical presentation. Pneumonia with bacteremia was the most common primary clinical presentation in 2008 (71%) followed by bacteremia (13%). Nineteen cases had a secondary pneumococcal-related diagnosis in 2008 – 13 pneumonia, 3 cellulitis, 1 endocarditis, 1 empyema and 1 septic arthritis.

Figure 8: Primary Clinical Presentations of Invasive Pneumococcal Disease - Alaska, 2008



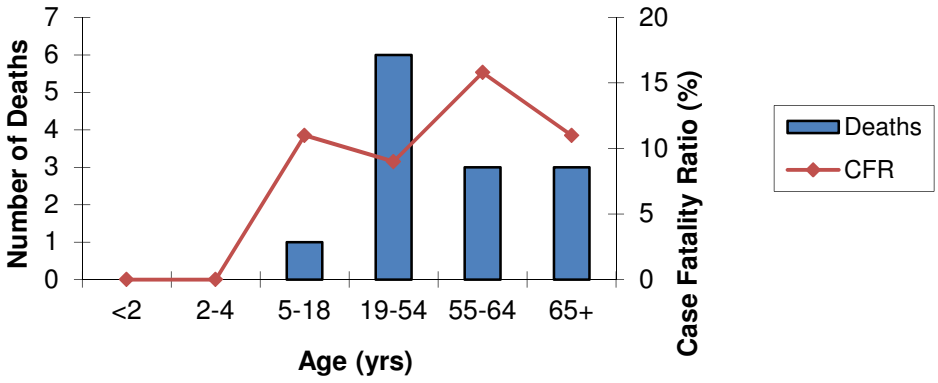
*with bacteremia

In 2008, blood was the most common source of a positive culture which was used to identify 138 (95%) of 146 cases. Cerebrospinal fluid was the positive site for 4 (3%) cases, 3 cases were identified from pleural fluid and 1 case from an abscess.

Mortality

In 2008, the overall case fatality ratio for *S. pneumoniae* in Alaska was 8.8% (13 deaths out of 148 cases for which outcomes were known). The case fatality ratio for AK Natives was higher than non-Natives; 9.2% (7 deaths) and 8.3% (6 deaths), respectively. Although the majority of deaths occurred in the 19-54 age category (6 deaths), the highest case fatality ratio occurred in the 55-64 age category; 15.8% (5 deaths).

Figure 9: Invasive Pneumococcal Deaths & Case Fatality Ratios by Age Group - Alaska, 2008



Serotype

Serotyping of invasive pneumococcal isolates is performed at AIP using internationally standardized methods. Serotype identification is based on the organism's polysaccharide capsule which is a principal virulence factor for pneumococci. This information provides a way to categorize organisms and to determine if the infection was due to a type that could be prevented by use of one of the available pneumococcal vaccines. Serotyping was performed on all of the *S. pneumoniae* cases for which an isolate was available.

Table 3: Invasive Pneumococcal Serotype Distribution by Race and Age Group – Alaska, 2008

		Alaska Native				Non-Native			
Serotype	Total n (%)	<2	2-18	19-64	65+	<2	2-18	19-64	65+
03	3 (2)	1	-	-	-	-	1	1	-
06A	2 (1)	-	-	1	-	-	-	-	1
06C	2 (1)	-	-	1	-	-	-	1	-
07C	1 (<1)	-	-	-	-	-	-	1	-
07F	29 (22)	2	3	4	-	1	3	13	3
08	7 (5)	-	-	4	-	-	1	2	-
09N	1 (<1)	-	-	-	-	-	-	-	1
09V	1 (<1)	-	-	-	-	-	-	1	-
10A	3 (2)	-	-	1	-	-	-	-	2
10F	2 (1)	-	-	-	-	-	-	-	2
11A	2 (1)	-	-	-	-	-	-	1	1
12F	11 (8)	-	-	7	1	-	-	3	-
15A	4 (3)	1	-	1	-	-	-	2	-
15B	2 (1)	-	-	1	-	-	-	1	-
16F	4 (3)	-	-	1	1	-	-	-	2
19A	28 (21)	7	4	4	2	-	1	8	2
19F	2 (1)	1	-	-	1	-	-	-	-
20	8 (6)	-	-	6	1	-	-	1	-
22F	11 (8)	-	1	3	-	-	-	5	2
23A	1 (<1)	-	-	1	-	-	-	-	-
23B	4 (3)	1	-	-	-	-	1	1	1
31	1 (<1)	-	-	1	-	-	-	-	-
33F	3 (2)	-	1	1	-	-	-	-	1
35B	3 (2)	1	-	1	1	-	-	-	-
Total	135	14	9	38	7	1	7	41	18

In 2008, the most common pneumococcal serotypes were 7F (29 isolates, 22%) and 19A (28 isolates, 21%). From 1986 through 2001, serotype 14 was the most common invasive pneumococcal serotype ranging from 7.4% to 23.5% of isolates. Following introduction in 2001 of the pneumococcal conjugate vaccine which includes serotype 14, the proportion of serotype 14 isolates dropped to 1.5% of serotyped isolates in 2006 and did not cause any invasive pneumococcal disease in 2008. However, disease caused by serotypes 7F and 19A, which are not included in the conjugate vaccine, has increased. Prior to 2005, yearly numbers of cases of serotype 7F disease and the proportion of total isolates have ranged from 1 to 10 and 0.9% to 9.3%, respectively. Although the majority (62.5%) of serotype 7F disease occurred in AK Natives during 2005, it was more evenly distributed between AK Native people (48%) and non-Natives (52%) in 2006. In 2007, the proportion of serotype 7F disease increased in non-Natives (57%) versus AK Natives (43%) and reached 69% versus 31%, respectively, in 2008. The majority (66%) of serotype 7F cases occurred in the Anchorage area in 2008.

Table 4: Invasive Pneumococcal Serotype Distribution by Region – Alaska, 2008

Serotype	Anchorage	Arctic Slope	Bristol Bay	Interior	Kotzebue	Norton Sound	Southeast	YK Delta
03	2	-	-	-	-	1	-	-
06A	1	-	-	1	-	-	-	-
06C	1	-	-	1	-	-	-	-
07C	1	-	-	-	-	-	-	-
07F	19	-	-	5	-	-	3	2
08	3	-	-	-	1	1	2	-
09N	1	-	-	-	-	-	-	-
09V	1	-	-	-	-	-	-	-
10A	1	-	-	-	-	-	1	1
10F	2	-	-	-	-	-	-	-
11A	1	-	-	1	-	-	-	-
12F	5	-	1	-	-	-	-	5
15A	2	-	-	1	-	-	-	1
15B	1	-	-	-	-	-	1	-
16F	2	-	-	-	-	-	2	-
19A	8	2	1	8	-	1	2	6
19F	1	-	-	-	-	-	1	-
20	5	-	-	3	-	-	-	-
22F	7	1	-	-	-	-	1	2
23A	-	-	-	-	-	-	-	1
23B	2	-	-	1	-	-	-	1
31	1	-	-	-	-	-	-	-
33F	2	-	-	-	-	-	-	1
35B	1	-	-	-	1	-	-	1
Total	70	3	2	21	2	3	13	21

Vaccine Serotypes

Two vaccine types were licensed for prevention of pneumococcal disease in 2008. In 2001, the pneumococcal conjugate vaccine (PCV7) was included in the Alaska childhood vaccination schedule. This vaccine provides protection against the 7 most common pneumococcal serotypes causing invasive disease among children (types 4, 6B, 9V, 14, 18C, 19F, 23F). The table below shows the proportion of invasive infections from 2008 that were due to serotypes found in the PCV7 vaccine. There was one case of pneumococcal disease caused by a serotype (19F) contained in the PCV7 vaccine in a child less than 5 years of age, the age group for which the vaccine is recommended, however, the child had not received any doses of vaccine.

Table 5: Proportion of Invasive Isolates Contained in the PCV7 Vaccine by Age Group and Race – Alaska, 2008

Age (yrs)	Alaska Native (%)	Non-Native (%)	Total (%)
<2	1 (7%) of 14	0 (0%) of 1	1 (7%) of 15
2-4	0 (0%) of 4	0 (0%) of 4	0 (0%) of 8
5+	1 (2%) of 49	1 (2%) of 59	2 (2%) of 108
Total	2 (3%) of 67	1 (2%) of 64	3 (2%) of 131

For the year covered by this report, the 23-valent polysaccharide vaccine (Ps23V) was recommended in Alaska for all persons 55 years and older, and for persons over age 2 who are at higher risk for pneumococcal disease. Revaccination was recommended after 6 years [6]. In 2008, for persons 55 years and older, 31 (74%) of 42 cases serotyped were potentially vaccine preventable invasive pneumococcal illnesses.

Vaccine Failures

A PCV7 vaccine failure is defined as invasive pneumococcal disease caused by a serotype contained in the PCV7 vaccine in a child less than five years old who has had at least two doses of vaccine. There were no vaccine failures in 2008.

Potentially Preventable Deaths

In 2008, pneumococcal vaccine status was known for 96 (66%) of the 146 cases; 59 cases (40%) did receive a pneumococcal vaccine prior to illness and 37 cases (25%) had no record of a pneumococcal vaccine.

Table 6: Potentially Vaccine Preventable Invasive Pneumococcal Deaths – Alaska, 2008

Serotypes	< 2 years	2-4	5-18	19-54	55-64	65+	Total
PCV7	0	0	0	1 (17%)	0	0	1 (8%)
Ps23V	0	0	1 (100%)	3 (50%)	2 (67%)	3 (100%)	9 (69%)
Non-Vaccine	0	0	0	1 (17%)	0	0	1 (8%)
Unknown	0	0	0	1 (17%)	1 (33%)	0	2 (15%)
Total	0	0	1	6	3	3	13

Overall, 69% of all pneumococcal-related mortality in 2008 was potentially preventable with the use of the 23-valent polysaccharide vaccine in persons over 2 years old; 16% of deaths were due to disease caused by serotypes not contained in the 23-valent vaccine.

Nine of the 13 deaths in 2008 from invasive *S. pneumoniae* occurred from serotypes contained within the Ps23V vaccine; 5 of the deaths were in individuals eligible for the vaccine. Of those five deaths, two occurred in vaccinated individuals; time since vaccination for each was 3 years and 12 years.

Table 7: Invasive Pneumococcal Disease, Serotypes of Fatal Cases – Alaska, 2009

Serotype	Deaths n (%)	Serotype Frequency (n)
03*	1 (33%)	3
08*	1 (14%)	7
09V†*	1 (100%)	1
10A*	1 (33%)	3
15A	1 (25%)	4
20*	3 (38%)	8
22F*	2 (18%)	11
33F*	1 (33%)	3

†Serotypes contained in the 7-valent conjugate vaccine
*Serotypes contained in the 23-valent polysaccharide vaccine

Associated Medical Conditions

The presence of one or more associated medical conditions was reported in 86% of invasive pneumococcal cases in 2008. Cigarette smoking was the most prevalent risk factor observed in adults followed by alcohol abuse and chronic lung disease.

Table 8: Associated Medical Conditions Identified in Invasive Pneumococcal Cases – Alaska, 2008*

Medical Condition/Risk Factor	Adult Cases (≥ 18 years) n=112, Cases (%)
Cigarette smoking	53 (47)
Alcohol abuse	40 (36)
Chronic lung disease	28 (25)
Diabetes	17 (15)
Immunosuppressive treatment	5 (5)
Injection drug use	0 (0)
Asplenia	0 (0)

*More than one risk factor was identified in several cases

Antibiotic Resistance

Susceptibility testing was performed on all isolates received in 2008. Results of the testing are presented in the following table.

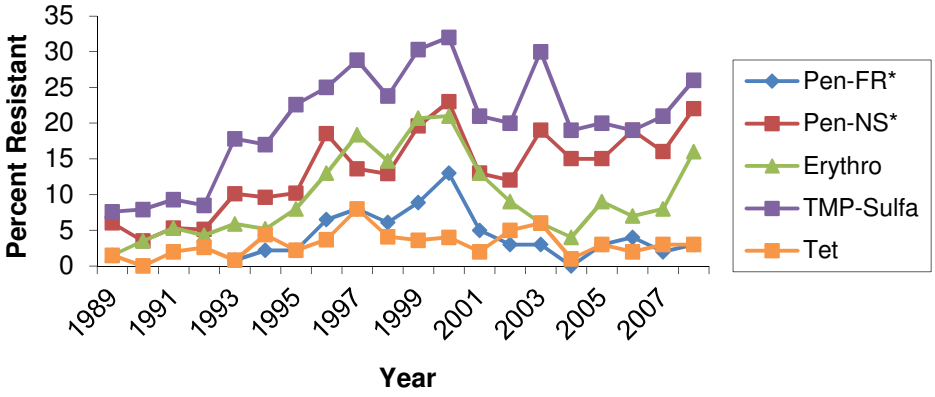
Table 9: Antibiotic Resistance in Invasive *Streptococcus pneumoniae* Isolates – Alaska, 2008

Antibiotic	Susceptible	Intermediate	Resistant	I + R	Total Tested
Penicillin	106 (79%)	25 (19%)	4 (3%)	29 (22%)	135
TMP-sulfa	100 (74%)	9 (7%)	26 (19%)	35 (26%)	135
Erythromycin	114 (84%)	0 (0%)	21 (16%)	21 (16%)	135
Ceftriaxone	130 (96%)	3 (2%)	2 (2%)	5 (3%)	135
Tetracycline	131 (97%)	0 (0%)	4 (3%)	4 (3%)	135
Chloramphenicol	133 (98%)	0 (0%)	2 (1%)	2 (1%)	135
Rifampin	135 (100%)	0 (0%)	0 (0%)	0 (0%)	135
Vancomycin	133 (98%)	0 (0%)	2 (2%)	2 (2%)	135
Levofloxacin	131 (97%)	0 (0%)	4 (3%)	4 (3%)	135
Clindamycin	134 (99%)	0 (0%)	1 (1%)	1 (1%)	135

Cut points from the Minimum Inhibitory Concentration (MIC) Interpretive Standards were used to determine if an isolate was 'susceptible', 'intermediate', or 'resistant' to the antibiotic being tested [7]. The MIC Interpretive Standards definitions of 'susceptible', 'intermediate', and 'resistant' can be found in the Appendix.

Serotypes found in the PCV7 vaccine are more likely to be non-susceptible to penicillin and erythromycin than non-vaccine serotypes. One potential benefit of the use of this vaccine was an anticipated decline in antibiotic resistance among circulating pneumococci. Following the initiation of the PCV7 vaccine in 2001, antibiotic resistance among invasive pneumococci dropped. During 2003, TMP-sulfa and penicillin resistance increased, however, both decreased in 2004 to similar levels of resistance seen in 2002 and remained at those levels until 2008 when both show an increase. After steadily declining from 2000 to a low of 4% in 2004, erythromycin resistance has increased to 16% of tested isolates in 2008.

Figure 10: Trends in Antibiotic Resistance Among Invasive Pneumococcal Isolates - Alaska, 1989 - 2008



*Pen-FR = fully resistant, Pen-NS = non-susceptible

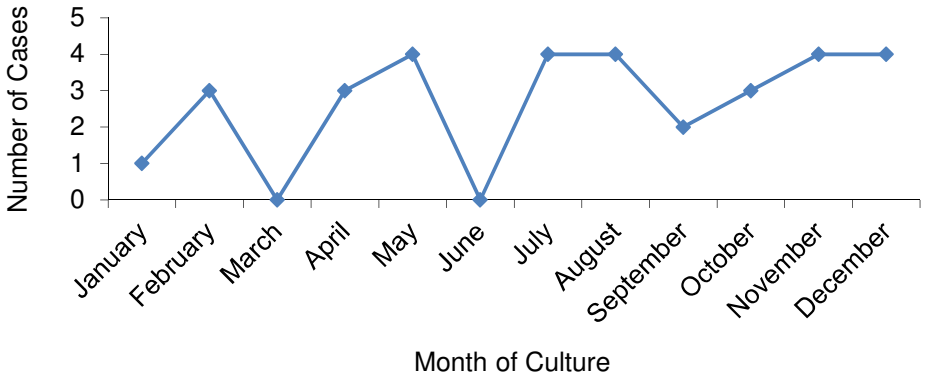
Invasive *Haemophilus influenzae*

Overall Incidence

In 2008, there were 21 cases of invasive *Haemophilus influenzae* in Alaska, for a statewide rate of 3.1/100,000 persons per year. This rate is higher than the national projected rate of 1.55/100,000 persons per year [7]. There were three deaths caused by *H. influenzae* in 2008 for a case fatality ratio of 14%.

Seasonality

Figure 11: *Haemophilus influenzae* Disease by Month of Culture - Alaska, 2008

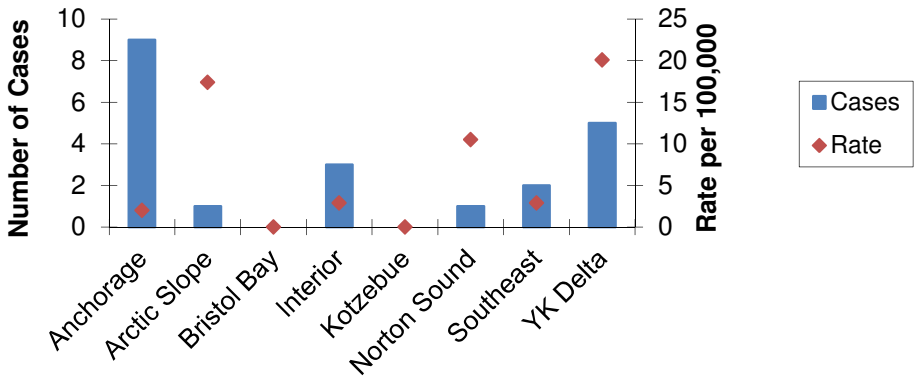


Cases of invasive *H. influenzae* occurred throughout 2008; however, due to the small number of cases, trends in seasonality cannot be determined.

Region

The highest rates of disease caused by invasive *H. influenzae* cases in 2008 were in YK Delta, 20.1/100,000 (5 cases), and the Arctic Slope, 17.4/100,000 (1 case). The largest number of cases occurred in the Anchorage area (9 cases), but the rate was much lower (2/100,000).

Figure 12: Invasive *Haemophilus influenzae*, Cases & Rates by Region - Alaska, 2008



Race

Table 10: Invasive *Haemophilus influenzae* Cases by Race – Alaska, 2008

Race	Cases n (%)	Age Adjusted Rate*	% Male	Deaths n (%)
Alaska Native	10 (48%)	6.6	60	0 (0%)
Non-Native	11 (52%)	1.6	64	3 (27%)
Total	21		62	3 (14%)

*Cases per 100,000 per percent distribution of Alaska 2000 population

In 2008, 52% of the cases occurred in non-Natives. Age-adjusted rates were calculated for Alaska Natives and non-Natives. The age-adjusted rate ratio of *H. influenzae* disease for the Alaska Native population compared with the non-Native population in 2008 was 4.1.

Age

H. influenzae cases ranged in age from newborn to 93 years of age in 2008 (median 54.4 years). Overall, the highest rates of disease occurred in children less than 2 years old and adults 65 and older.

Rates of disease in Alaska Native versus non-Native populations by age group were variable; overall numbers of cases and rates by race and age group are presented in Figure 14. The highest rates of disease occurred in Alaska Native children less than two years of age, 45.2/100,000 persons per year and Alaska Native adults 65 years and older, 25.1/100,000 persons per year.

Figure 13: Invasive *Haemophilus influenzae* by Age Group - Alaska, 2008

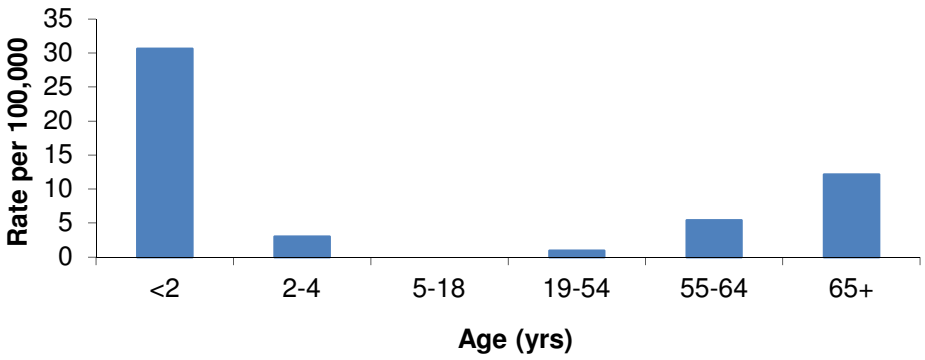
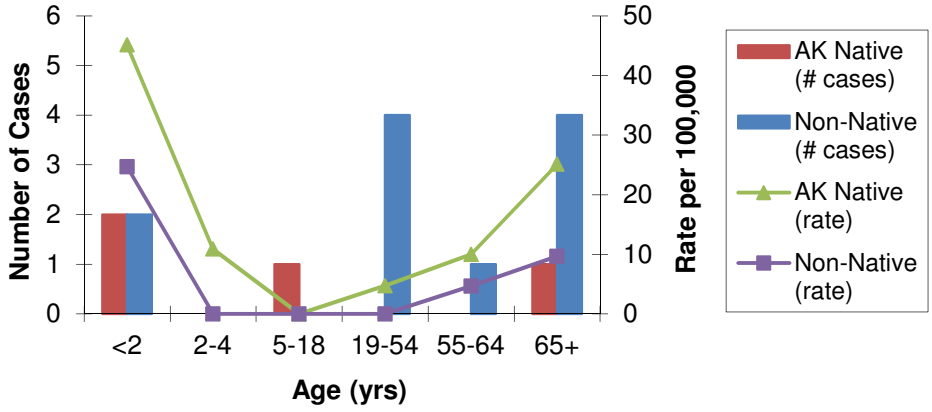


Figure 14: Invasive *Haemophilus influenzae*, Cases & Rates by Age Group & Race - Alaska, 2008



Clinical Presentation

The primary clinical presentation was determined by a review of the discharge diagnoses in each patient's individual medical record associated with the invasive bacterial illness. For cases with more than one diagnosis, the most serious *H. influenzae*-related diagnosis was recorded as the primary clinical presentation. In 2008, pneumonia with bacteremia was the most common presentation (43% of cases).

H. influenzae was isolated from 17 (81%) blood samples, 2 (10%) cerebrospinal fluid samples, 1 (5%) pleural fluid sample, and 1 (5%) joint fluid sample.

Table 11: Primary Clinical Presentation of Invasive *Haemophilus influenzae* - Alaska, 2008

Primary Presentation	n (%)
Pneumonia*	9 (43%)
Bacteremia	7 (33%)
Meningitis	2 (10%)
Septic Arthritis	2 (10%)
Empyema	1 (5%)
Total	21

*with bacteremia

Serotypes

All isolates received at AIP are serotyped; 20 of the 21 cases in 2008 had isolates and were serotyped. The bacterial capsule is the basis for serotyping and is the primary virulence factor. Serotype b has been the most common serotype in the past, but its prevalence has decreased with use of the childhood Hib vaccine. Surveillance of serotypes is important for monitoring vaccine effectiveness and emergence of non-vaccine serotypes.

Table 12: Serotypes of Invasive *Haemophilus influenzae* Cases by Race – Alaska, 2008

		Alaska Native				Non-Native			
Serotype	Total n (%)	<2	2-18	19-64	65+	<2	2-18	19-64	65+
a	2	0	1	0	0	1	0	0	0
b	3	2	0	1	0	0	0	0	0
e	1	0	0	1	0	0	0	0	0
f	1	0	0	0	0	1	0	0	0
NT*	13	1	0	2	2	2	0	2	4
Total	20	3	1	4	2	4	0	2	4

*Non-typable

Hib

In recent years, the prevalence of *H. influenzae* type b has declined due to increased use of a childhood vaccine against this serotype. Three cases of Hib occurred in 2008; two in unvaccinated children under the age of 2 and one in a 43 year old adult.

Antibiotic Resistance

Nineteen *Haemophilus influenzae* isolates received at AIP were tested for susceptibility to chloramphenicol, ceftriaxone and TMP/sulfa. All 19 isolates were susceptible to ceftriaxone; one isolate was fully resistant to chloramphenicol; 2 were fully resistant to TMP/sulfa 3 had intermediate resistance and 14 were susceptible.

Table 13: Summary of Invasive *Haemophilus influenzae* Case Characteristics, Alaska, 2008

Sex	Age (Yrs)	Race	Residence	Site of Isolation	Clinical Presentation(s)	Serotype*	Associated Medical Conditions	Survived
M	Newborn	Non-Native	Other	Blood	Bacteremia	NT	None	Yes
F	Newborn	AK Native	Other	Blood	Bacteremia	NT	None	Yes
M	10 days	Non-Native	Anchorage	Blood	Bacteremia	NT	None	Yes
M	0.2	AK Native	Other	CSF	Meningitis	b	None	Yes
M	0.5	Non-Native	Other	CSF	Meningitis	f	None	Yes
M	0.6	Non-Native	Anchorage	Blood	Septic arthritis	a	None	Yes
F	1.2	AK Native	Other	Blood	Pneumonia	b	None	Yes
M	2.4	AK Native	Other	Blood	Pneumonia	a	Chronic lung disease	Yes
M	43.5	AK Native	Anchorage	Blood	Pneumonia	b	Smoking, alcohol abuse	Yes
M	45.5	AK Native	Other	Blood	Pneumonia	e	Smoking, immunosuppressive treatment	Yes
M	54.4	AK Native	Anchorage	Blood	Bacteremia	NT	Smoking	Yes
M	56.2	Non-Native	Anchorage	Joint fluid	Septic arthritis	Unknown	Immunosuppressive treatment	Yes
F	62.3	AK Native	Other	Blood	Pneumonia	NT	Chronic lung disease	Yes
M	63.5	Non-Native	Anchorage	Blood	Pneumonia	NT	Diabetes	No
F	64.2	Non-Native	Anchorage	Pleural fluid	Empyema, pneumonia	NT	Smoking, chronic lung disease, diabetes	No
M	75.7	AK Native	Other	Blood	Pneumonia	NT	Chronic lung disease	Yes
F	77.4	Non-Native	Anchorage	Blood	Bacteremia	NT	None	Yes
M	80.1	Non-Native	Other	Blood	Pneumonia	NT	Diabetes	Yes
F	85.7	Non-Native	Anchorage	Blood	Pneumonia	NT	None	Yes
F	92.4	Non-Native	Other	Blood	Bacteremia	NT	None	No
F	92.7	AK Native	Other	Blood	Bacteremia	NT	None	Yes

*NT = non-typeable

Invasive *Neisseria meningitidis*

Overall Incidence

A total of 5 cases of invasive *Neisseria meningitidis* were reported to AIP in 2008 for an overall rate of 0.7/100,000. The Alaska rates are slightly higher than the ABCs 2008 national projected rate of 0.3/100,000 [9]. There were no invasive *N. meningitidis*-related deaths in Alaska in 2008.

Seasonality

One *N. meningitidis* case occurred in each month of April, June, July, August and October; no clusters of related cases were reported.

Race

In 2008, 80% of the cases occurred in non-Natives. Age-adjusted rates were calculated for Alaska Natives and non-Natives. The age-adjusted rate ratio of *N. meningitidis* disease for the non-Native population compared with the Alaska Native population in 2008 was 1.7.

Table 14: Invasive *Neisseria meningitidis* Cases by Race – Alaska, 2008

Race	Cases n (%)	Age Adjusted Rate*	% Male	Deaths n (%)
Alaska Native	1 (20%)	0.45	0	0 (0%)
Non-Native	4 (80%)	0.75	75	0 (0%)
Total	5		60	0

*Cases per 100,000 per percent distribution of Alaska 2000 population

Region

Four cases of invasive *N. meningitidis* occurred in Anchorage and one case occurred in the Interior.

Age

Invasive *N. meningitidis* cases reported in 2008 ranged in age from 0.2 to 29.6 years old; the median age was 0.6 years.

Clinical Presentation

The primary clinical presentation was determined by a review of the discharge diagnoses in each patient's individual medical record associated with the invasive bacterial illness. In cases with multiple discharge diagnoses, the most serious diagnosis related to the *N. meningitidis* infection was recorded as the primary clinical presentation. Four cases presented with meningitis and one with bacteremia; one case had a secondary clinical presentation of cellulitis.

N. meningitidis was isolated from cerebrospinal fluid in four of five (80%) cases in 2008. One case was isolated from blood.

Mortality

There were no *N. meningitidis*-related deaths reported in Alaska in 2008.

Serogroup

Five invasive *N. meningitidis* cases in 2008 were serogrouped; three were serogroup B and two were serogroup Y.

Table 15: Summary of Invasive *Neisseria Meningitidis* Cases Characteristics, Alaska, 2008

Sex	Age (yrs)	Race	Residence	Site of Isolation	Clinical Presentation(s)	Serogroup	Associated Medical Conditions	Survived
M	0.2	Non-Native	Anchorage	CSF	Meningitis	B	None	Yes
F	0.2	AK Native	Other	Blood	Bacteremia	Y	None	Yes
M	0.6	Non-Native	Anchorage	CSF	Meningitis, cellulitis	Y	None	Yes
M	1.4	Non-Native	Anchorage	CSF	Meningitis	B	None	Yes
F	20.6	Non-Native	Anchorage	CSF	Meningitis	B	None	Yes

Invasive group A *Streptococcus*

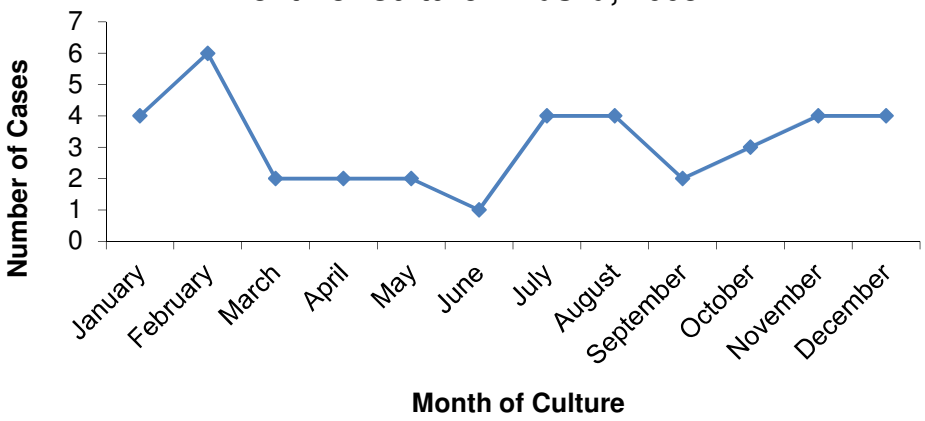
Overall Incidence

A total of 38 cases of invasive group A *Streptococcus* (GAS) were reported to AIP in 2008. The overall rate of invasive GAS disease in the state of Alaska was 5.6/100,000 persons per year. The Alaska rate is higher than the ABCs 2008 national projected rate of 3.9/100,000 [10]. In 2008, there were 5 GAS-related deaths (*emm* types 1 (2 cases), 73, 108.1 and one unknown) for a case fatality ratio of 13.2%.

Seasonality

Cases of group A *Streptococcus* occurred throughout the year in 2008 with no apparent trends in seasonality.

Figure 15: Invasive group A *Streptococcus*, by Month of Culture - Alaska, 2008



Race

In 2008, 47% of invasive GAS cases in Alaska occurred in the Alaska Native population for an age-adjusted rate of 12.3/100,000 persons per year which was three and a half times higher than the non-Native age-adjusted rate of 3.5/100,000 persons per year.

Table 16: Invasive group A *Streptococcus* Cases by Race – Alaska, 2008

Race	Cases n (%)	Age Adjusted Rate*	% Male	Deaths n (%)
Alaska Native	17 (45%)	12.3	65	1 (6%)
Non-Native	21 (55%)	3.5	71	4 (19%)
Total	38		68	5 (13%)

*Cases per 100,000 per percent distribution of Alaska 2000 population

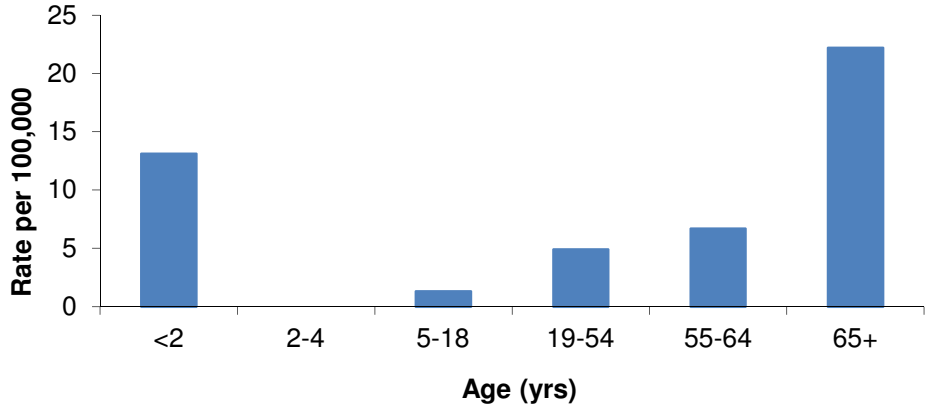
Region

Twenty five (65.8%) of the 38 invasive group A *Streptococcus* cases in 2008 were reported in the Anchorage area, 6 cases in the YK Delta, 3 cases each in Southeast and Kotzebue, and one case in the Interior.

Age

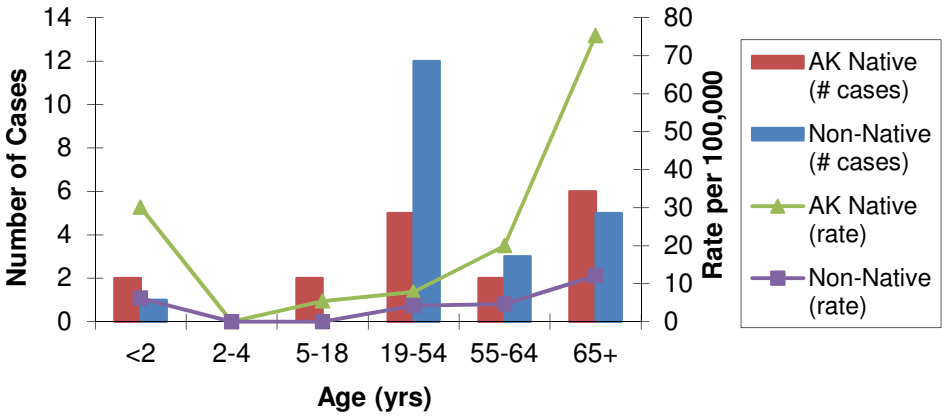
Invasive group A *Streptococcus* cases reported in 2008 ranged in age from 2.4 months to 87.2 years old; the median age was 51.6 years. Highest rates of disease occurred in adults 65 and older (22.2/100,000).

Figure 16: Invasive group A *Streptococcus* by Age Group - Alaska, 2008



When stratified by race, the highest rates of invasive group A streptococcal disease occurred in Alaska Native adults 65 and older (75.3/100,000 persons per year). The highest GAS disease rate in the non-Native population occurred in adults 65 and older (12.1/100,000 persons per year).

Figure 17: Invasive group A *Streptococcus*, Cases & Rates by Age Group & Race - Alaska, 2008



Clinical Presentation

The primary clinical presentation was determined by a review of the discharge diagnoses in each patient's individual medical record associated with the invasive bacterial illness. In cases with multiple discharge diagnoses, the most serious diagnosis related to the GAS infection was recorded as the primary clinical presentation. Table 17 shows the primary clinical presentations of invasive group A *Streptococcus* in Alaska for 2008. Nine cases also presented with secondary diagnoses including endocarditis, cellulitis, osteomyelitis and bursitis.

Group A *Streptococcus* was isolated from blood samples in 32 (84%) of 38 cases, five from joint fluid and one from a surgical sample.

Table 17: Primary Clinical Presentations of Invasive group A *Streptococcus* – Alaska, 2008

Primary Presentation	n (%)
Cellulitis*	15 (39%)
Pneumonia*	8 (21%)
Bacteremia	7 (18%)
Septic arthritis	2 (5%)
Necrotizing fasciitis	2 (5%)
Meningitis	1 (3%)
Bursitis	1 (3%)
Other	2 (5%)
Total	38

*with bacteremia

Table 18: Summary of Invasive group A *Streptococcus* Case Characteristics, Alaska, 2008

Sex	Age (yrs)	Race	Residence	Site of Isolation	Clinical Presentation(s)	*emm* Type	Associated Medical Conditions	Survived
M	0.2	Non-Native	Anchorage	Blood	Bacteremia	9.00	None	Yes
M	0.6	AK Native	Other	Blood	Cellulitis	82.00	None	Yes
M	1.2	AK Native	Other	Blood	Bacteremia	82.00	None	Yes
F	6.1	AK Native	Other	Blood	Cellulitis	12.00	None	Yes
M	18.5	AK Native	Anchorage	Blood	Bacteremia	108.10	Chronic lung disease, diabetes	Yes
F	24	Non-Native	Anchorage	Blood	Bacteremia, other	1.00	None	No
M	32.3	Non-Native	Anchorage	Blood	Cellulitis		Smoking, diabetes	Yes
M	33	AK Native	Anchorage	Blood	Cellulitis	58.00	Smoking, alcohol abuse	Yes
F	33	Non-Native	Anchorage	Blood	Other	108.10	Smoking	Yes
F	35.9	Non-Native	Other	Blood	Other	44.00	Chronic lung disease	Yes
F	41.2	Non-Native	Anchorage	Blood	Cellulitis	108.10	Diabetes	Yes
F	41.8	Non-Native	Anchorage	Blood	Meningitis, endocarditis, pneumonia	73.00	Smoking, chronic lung disease, alcohol abuse, diabetes	No
M	47	AK Native	Anchorage	Blood	Cellulitis	108.10	Smoking, alcohol abuse	Yes
M	47.3	Non-Native	Anchorage	Blood	Cellulitis	108.10	Smoking, alcohol abuse, diabetes	Yes
M	49	AK Native	Other	Joint fluid	Septic arthritis, cellulitis	82.00	Smoking	Yes
F	49.1	Non-Native	Anchorage	Joint fluid	Cellulitis, bursitis	9.20	Chronic lung disease, diabetes	Yes
M	49.5	Non-Native	Anchorage	Joint fluid	Cellulitis, bursitis		Smoking, chronic lung disease, alcohol abuse	Yes
M	49.7	Non-Native	Anchorage	Blood	Pneumonia	1.00	Asplenia	No
M	51	Non-Native	Anchorage	Blood	Pneumonia	82.00	Alcohol, immuno-suppressive treatment	Yes
M	52.2	AK Native	Anchorage	Wound	Necrotizing fasciitis		Smoking, chronic lung disease, alcohol abuse	Yes
F	54.4	AK Native	Other	Blood	Pneumonia, cellulitis	1.00	Smoking, alcohol abuse, injection drug use	Yes
M	54.5	Non-Native	Anchorage	Blood	Necrotizing fasciitis	108.10	Alcohol abuse	No
M	57.3	Non-Native	Anchorage	Blood	Bacteremia	92.00	Smoking	Yes
M	58.6	Non-Native	Anchorage	Blood	Cellulitis		Smoking, alcohol abuse, diabetes	Yes
F	59.8	AK Native	Other	Blood	Bacteremia	44.00	Smoking	Yes
M	62	Non-Native	Anchorage	Blood	Cellulitis	108.10	Diabetes	Yes
M	64.2	AK Native	Anchorage	Blood	Cellulitis	92.00	Smoking, alcohol abuse	Yes
M	68	Non-Native	Anchorage	Blood	Cellulitis		None	Yes
M	69.4	Non-Native	Anchorage	Blood	Cellulitis, other	1.00	Chronic lung disease, diabetes	Yes
M	70.7	AK Native	Other	Joint fluid	Bursitis		Unknown	Yes
M	71.7	AK Native	Other	Blood	Pneumonia	1.00	None	Yes
M	72.6	Non-Native	Anchorage	Blood	Bacteremia	1.00	None	Yes
F	74.2	AK Native	Other	Blood	Cellulitis		None	Yes
M	76.8	Non-Native	Anchorage	Blood	Pneumonia	28.00	None	Yes
F	81	AK Native	Other	Blood	Pneumonia, osteomyelitis		Chronic lung disease	No
M	82.3	AK Native	Other	Joint fluid	Septic arthritis, cellulitis		Diabetes	Yes
M	83.2	Non-Native	Anchorage	Blood	Pneumonia	82.00	Chronic lung disease, diabetes	Yes
F	87.2	AK Native	Other	Blood	Pneumonia	49.00	None	Yes

Invasive group B *Streptococcus*

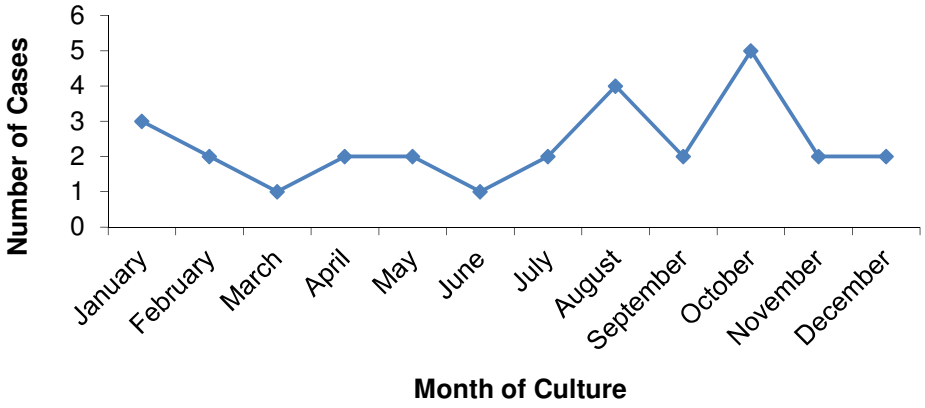
Overall Incidence

A total of 28 cases of invasive group B *Streptococcus* (GBS) were reported to AIP in 2008. The overall rate of invasive GBS disease in the state of Alaska was 4.1/100,000 persons per year. The Alaska rate is lower than the ABCs 2008 national projected rate of 6.5/100,000 [11]. In 2008, there was one GBS-related death for a case fatality ratio of 3.7% (outcome was unknown in 1 case).

Seasonality

Cases of group B *Streptococcus* occurred throughout the year with no apparent trends in seasonality.

Figure 18: Invasive group B *Streptococcus*, by Month of Culture - Alaska, 2008



Race

In 2008, 37% of invasive group B *Streptococcus* cases in Alaska occurred in the Alaska Native population; the age-adjusted rate was 5.7/100,000 persons per year which is more than one and half times the non-Native age-adjusted rate of 3.1/100,000 persons per year.

Table 19: Invasive group B *Streptococcus* Cases by Race – Alaska, 2008

Race	Cases n (%)	Age Adjusted Rate*	% Male	Deaths n (%)
Alaska Native	8 (29)	5.7	87.5	0 (0)
Non-Native	20 (71)‡	3.1	60	1 (5.3)
Total	28		68	1 (3.7)

*Cases per 100,000 per percent distribution of Alaska 2000 population
‡Includes one case for which race was unknown

Region

In 2008, 20 (71%) of the 28 reported GBS cases occurred in Anchorage; four cases were reported in the Interior, three cases in Southeast Alaska, and one in the YK Delta.

Age

Invasive group B *Streptococcus* cases reported in 2008 ranged in age from newborn to 104.6 years old; the median age was 60.3 years. Highest rates of disease occurred in adults 65 years and older (24.3/100,000 persons per year).

Figure 19: Invasive group B *Streptococcus* by Age Group - Alaska, 2008

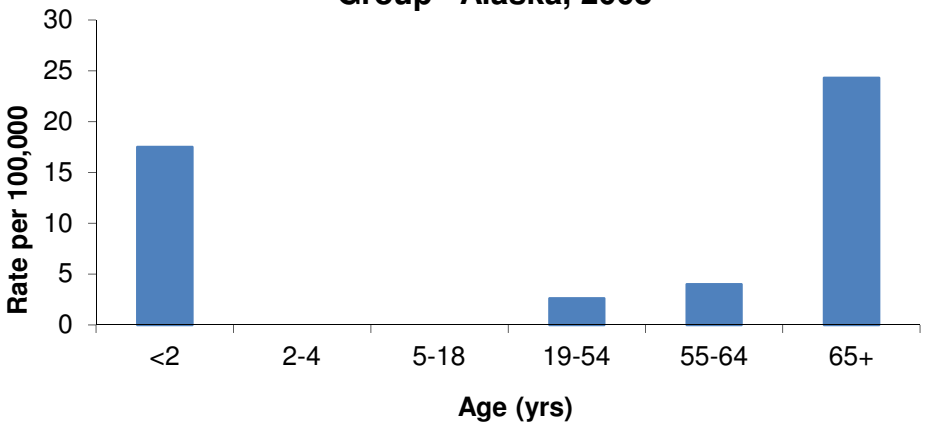
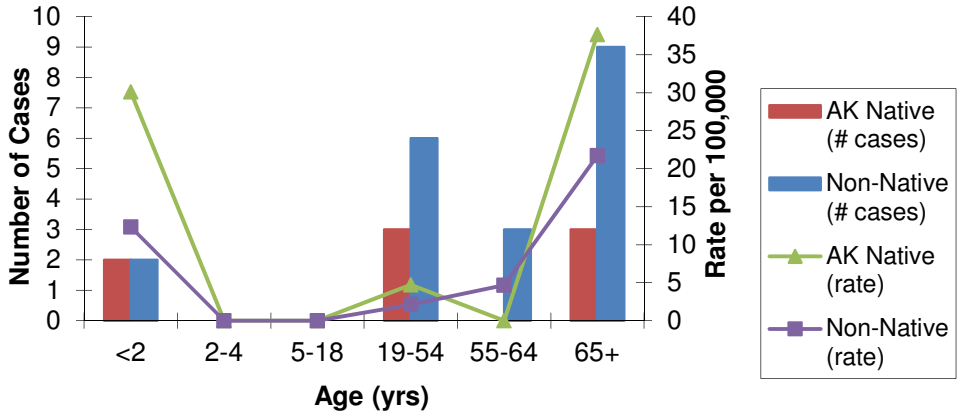


Figure 20: Invasive group B S*treptococcus*, Cases & Rates by Age Group & Race - Alaska, 2008



When stratified by race, the highest rates of disease occurred in AK Native adults 65 years of age and older (37.6/100,000 persons per year). There was one case of early-onset disease (less than 7 days old) for a rate of 0.1/1,000 births.

Clinical Presentation

The primary clinical presentation was determined by a review of the discharge diagnoses in each patient's individual medical record associated with the invasive bacterial illness. In cases with multiple discharge diagnoses, the most serious diagnosis related to the GBS infection was recorded as the primary clinical presentation. In 2008, the most common clinical presentation was bacteremia which occurred in 14 cases (50%).

Group B *Streptococcus* was isolated from blood in 22 (79%) of 28 cases in 2008; three cases were isolated from joint fluid and one case each was isolated from peritoneal fluid, a surgical specimen and an unspecified non-sterile site.

Table 20: Primary Clinical Presentations of Invasive group B *Streptococcus* – Alaska, 2008

Primary Presentation	n (%)
Bacteremia	14 (50)
Septic arthritis	5 (18)
Cellulitis*	3 (11)
Pneumonia*	2 (7)
Osteomyelitis	1 (3.5)
Meningitis	1 (3.5)
Peritonitis	1 (3.5)
Other	1 (3.5)
Total	28

*with bacteremia

Antibiotic Resistance

Susceptibility testing was performed on 25 GBS isolates received in 2008. Results of the testing are presented in the following table.

Table 21: Antibiotic Resistance in Invasive group B *Streptococcus* Isolates – Alaska, 2008

Antibiotic	Susceptible	Intermediate	Resistant	I + R	Total Tested
Penicillin	25 (100%)	0 (0%)	0 (0%)	0 (0%)	25
Ceftriaxone	25 (100%)	0 (0%)	0 (0%)	0 (0%)	25
Erythromycin	11 (44%)	0 (0%)	14 (54%)	14 (54%)	25
Tetracycline	1 (4%)	0 (0%)	24 (96%)	24 (96%)	25
Levofloxacin	25 (100%)	0 (0%)	0 (0%)	0 (0%)	25
Clindamycin	19 (76%)	0 (0%)	6 (24%)	6 (24%)	25
Vancomycin	25 (100%)	0 (0%)	0 (0%)	0 (0%)	25

All isolates tested were susceptible to penicillin, ceftriaxone, vancomycin and levofloxacin. Resistance to tetracycline, erythromycin and clindamycin was seen in 96%, 54% and 24%, respectively, of isolates tested. An isolate from the one early onset case was susceptible to all antibiotics tested.

Table 21: Summary of Invasive group B *Streptococcus* Case Characteristics, Alaska, 2008

Sex	Age (yrs)	Race	Residence	Site of Isolation	Clinical Presentation(s)	Associated Medical Conditions	Survived
M	Newborn	AK Native	Other	Blood	Bacteremia	None	Yes
M	11 days	Unknown	Other	Blood	Bacteremia	None	Yes
M	0.1	Non-Native	Other	Blood	Bacteremia	None	Yes
M	0.2	AK Native	Anchorage	Blood	Bacteremia	None	Yes
M	20.6	AK Native	Other	Blood	Bacteremia	Immunosuppressive treatment	Yes
F	25.3	Non-Native	Anchorage	Blood	Osteomyelitis	Diabetes	No
F	32.5	AK Native	Anchorage	Peritoneal fluid	Peritonitis, endometritis	Chronic lung disease	Yes
M	42.7	Non-Native	Anchorage	Blood	Cellulitis	Diabetes	Yes
M	48.1	AK Native	Anchorage	Blood	Bacteremia	None	Yes
M	50.1	Non-Native	Anchorage	Joint fluid	Septic arthritis	Smoking, alcohol abuse	Yes
F	50.6	Non-Native	Anchorage	Non-sterile	Cellulitis	None	Yes
F	52	Non-Native	Anchorage	Blood	Cellulitis	Diabetes	Yes
M	54.7	Non-Native	Other	Joint fluid	Septic arthritis	Diabetes	Yes
M	59	Non-Native	Anchorage	Blood	Cellulitis	None	Yes
M	61.6	Non-Native	Anchorage	Joint fluid	Septic arthritis	Unknown	Yes
M	62.4	Non-Native	Other	Blood	Bacteremia	None	Yes
M	75.1	AK Native	Anchorage	Blood	Bacteremia	Chronic lung disease, alcohol abuse, diabetes	Yes
F	75.2	Non-Native	Anchorage	Blood	Meningitis	Diabetes	Yes
M	75.4	Non-Native	Anchorage	Blood	Bacteremia	None	Yes
M	75.7	Non-Native	Anchorage	Blood	Bacteremia	Diabetes	Yes
M	76.1	AK Native	Other	Blood	Pneumonia	Diabetes	Yes
F	76.5	Non-Native	Anchorage	Blood	Septic arthritis	Immunosuppressive treatment	Yes
M	76.6	Non-Native	Anchorage	Blood	Bacteremia	Smoking, chronic lung disease	Yes
F	76.7	Non-Native	Anchorage	Blood	Bacteremia	Chronic lung disease	Yes
M	86.6	Non-Native	Anchorage	Blood	Pneumonia, cellulitis	Chronic lung disease	Yes
F	92.1	Non-Native	Anchorage	Blood	Bacteremia	None	Yes
F	95	Non-Native	Anchorage	Blood	Septic arthritis	None	Yes
M	104.6	AK Native	Other	Surgical specimen	Other	Chronic lung disease	Yes

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[10 Centers for Disease Control and Prevention. 2009. Active Bacterial Core Surveillance Report, Emerging Infections Program Network, Group A *Streptococcus*, 2008.

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Appendix

MIC Interpretive Standards Definitions:

CLSI [5] provides recommended interpretive categories for various Minimum Inhibitory Concentration values (cut points) for each organism/antibiotic combination which are defined as follows:

1. Susceptible (S):

The "susceptible" category implies that isolates are inhibited by the usually achievable concentrations of antimicrobial agent when the recommended dosage is used for the site of infection.

2. Intermediate (I):

The "intermediate" category includes isolates with antimicrobial agent MICs that approach usually attainable blood and tissue levels and for which response rates may be lower than for susceptible isolates. The "intermediate" category implies clinical efficacy applicability in body sites where the drugs are physiologically concentrated (e.g., quinolones and β-lactams in urine) or when a higher dosage of a drug can be used (e.g., β-lactams). The "intermediate" category also includes a buffer zone which should prevent small, uncontrolled technical factors from causing major discrepancies in interpretations, especially for drugs with narrow pharmacotoxicity margins.

3. Resistant (R):

Resistant strains are not inhibited by the usually achievable concentrations of the agent with normal dosage schedules, and/or that demonstrate MICs or zone diameters that fall in the range where specific microbial resistance mechanisms are likely (e.g., β-lactamases) are likely, and clinical efficacy of the agent against the isolate has not been reliably shown in treatment studies.